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MASUDA MAKOTO

(74) Representative:

(54) SEMICONDUCTIVE RESIN COMPOSITION FOR HIGH-VOLTAGE POWER CABLE

(57) Abstract:

PROBLEM TO BE SOLVED: To obtain a semiconductive resin compsn. which can give a high- voltage power cable having a semiconductive layer excellent in mechanical properties, releasability, and electrical conductivity by compounding a matrix comprising a polyethylene polymer

and a fine fluororesin powder in a specified ratio with a specified amt. of a carbon black.

SOLUTION: 100 pts.wt. matrix prepd. from 100 pts.wt. polyethylene polymer and 40-150 pts.wt. fine fluororesin powder is compounded with 10-100 pts.wt. carbon black. Examples of the polyethylene polymer are an ethylene-vinyl acetate copolymer, an ethylene-ethyl acrylate copolymer, and an ethylene-methyl acrylate copolymer. A tetrafluoroethylene resin is esp. pref. as the fluororesin. Acetylene black, furnace black, Ketjenblack, etc., are listed as the carbon black. The compsn. may further contain an org. peroxide for crosslinking.

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TECHNICAL FIELD

[The technical field to which invention belongs] This invention relates to the half-conductive resin constituent for high-tension-power cables.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] This invention is made in view of the trouble mentioned above, and the purpose is in offering the half-conductive resin constituent for high-tension-power cables which can offer the high-tension-power cable with which the detachability non-according [Siwa] to a metal shield tape and the conductivity of a semi-conducting layer were compatible, when crooked with the more excellent mechanical property.

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EFFECT OF THE INVENTION

[Effect of the Invention] The half-conductive resin constituent of this invention can offer a high-tension-power cable with the semi-conducting layer which Siwa was not based on a metal shield tape and was excellent in elongation, detachability, and conductivity, when a high-tension-power cable is crooked, since elevated-temperature bridge formation is suitably used to the semi-conducting layer of a high-tension-power cable.

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PRIOR ART

[Description of the Prior Art] A high-tension-power cable 6kV or more has the common thing of the three-layer mold which constituted the internal semi-conducting layer and the external semi-conducting layer from coincidence extrusion molding respectively on the inside and the outside of an insulating material for the purpose of the partial discharge prevention in the interface of a conductor and a metal shield tape (copper etc. is mention as a metal), and an insulating layer, and electrolysis intensive relaxation. Although the half-conductivity cloth tape which used cotton, nylon, etc. as the base material may be rolled between this external semi-conducting layer and a metal shield tape, those half-conductivity tapes may not be rolled but may roll a metal shield tape on an external semi-conducting layer directly. When a metal shield tape is directly rolled on an external semi-conducting layer, for the adhesion nature to the metal shield tape of an external semi-conducting layer, when a cable is made crooked, there is no slipping in a metal shield tape, and Siwa may be based on a metal shield tape. The temperature of an insulating material rises at the time of cable energization (for example, the time of the short-time allowable current 90-130 degrees C), since it becomes soft and expands, or these wrinklings eat into an insulating material, an electric shielding tape may cut with Siwa as the starting point, and the reliability of a cable is reduced. The method of kneading to spreading or resin of silicone oil etc., and improving slipping of an external semi-conducting layer and an electric shielding tape so that according to an electric shielding tape in Siwa is also learned. However, to the external semi-conducting layer which kneaded silicone oil, since the thermal resistance of silicone oil is generally near 150 degree C (even a high thing 200-250 degrees C), when performing bridge formation under the high temperature condition beyond it, it cannot be used. Therefore, a half-conductive resin constituent which can offer the high-tension-power cable with which the detachability non-according [Siwa] to a metal shield tape and the conductivity of a semi-conducting layer were compatible when crooked with the more excellent mechanical property was desired.
[0003]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] This invention relates to the half-conductive resin constituent for high-tension-power cables.
[0002]
[Description of the Prior Art] A high-tension-power cable 6kV or more has the common thing of the three-layer mold which constituted the internal semi-conducting layer and the external semi-conducting layer from coincidence extrusion molding respectively on the inside and the outside of an insulating material for the purpose of the partial discharge prevention in the interface of a conductor and a metal shield tape (copper etc. is mention as a metal), and an insulating layer, and electrolysis intensive relaxation. Although the half-conductivity cloth tape which used cotton, nylon, etc. as the base material may be rolled between this external semi-conducting layer and a metal shield tape, those half-conductivity tapes may not be rolled but may roll a metal shield tape on an external semi-conducting layer directly. When a metal shield tape is directly rolled on an external semi-conducting layer, for the adhesion nature to the metal shield tape of an external semi-conducting layer, when a cable is made crooked, there is no slipping in a metal shield tape, and Siwa may be based on a metal shield tape. The temperature of an insulating material rises at the time of cable energization (for example, the time of the short-time allowable current 90-130 degrees C), since it becomes soft and expands, or these wrinklings eat into an insulating material, an electric shielding tape may cut with Siwa as the starting point, and the reliability of a cable is reduced. The method of kneading to spreading or resin of silicone oil etc., and improving slipping of an external semi-conducting layer and an electric shielding tape so that according to an electric shielding tape in Siwa is also learned. However, to the external semi-conducting layer which kneaded silicone oil, since the thermal resistance of silicone oil is generally near 150 degree C (even a high thing 200-250 degrees C), when performing bridge formation under the high temperature condition beyond it, it cannot be used. Therefore, a half-conductive resin constituent which can offer the high-tension-power cable with which the detachability non-according [Siwa] to a metal shield tape and the conductivity of a semi-conducting layer were compatible when crooked with the more excellent mechanical property was desired.
[0003]
[Problem(s) to be Solved by the Invention] This invention is made in view of the trouble mentioned above, and the purpose is in offering the half-conductive resin constituent for high-tension-power cables which can offer the high-tension-power cable with which the detachability non-according [Siwa] to a metal shield tape and the conductivity of a semi-conducting layer were compatible, when crooked with the more excellent mechanical property.
[0004]
[Means for Solving the Problem] This invention is a half-conductive resin constituent for high-tension-power cables characterized by including the matrix 100 weight section of combination, and the conductive carbon black 10 - the 100 weight sections which consist of the polyethylene system polymer

100 weight section, and the fluorine system resin impalpable powder 40 - the 150 weight sections, and, thereby, can solve the above-mentioned technical problem.

[0005] A half-conductive resin constituent for high-tension-power cables of this invention can blend three components of a polyethylene system polymer, fluorine system resin impalpable powder, and conductive carbon black at least at the above-mentioned rate of specific combination, and can offer a high-tension-power cable with a semi-conducting layer excellent in a mechanical characteristic, detachability, and conductivity. In addition, especially a limit does not have combination sequence of these 3 component, and suitably, even when it is selectable, and is simultaneous 3 person and it is separate, it is not cared about.

[0006] A polyethylene system polymer used for this invention contains a homopolymer of ethylene, and a copolymer of ethylene and a monomer which can be copolymerized. As a polyethylene system polymer used for this invention, an ethylene-vinyl acetate copolymer (EVA), an ethylene ethyl-acrylate copolymer (EEA), an ethylene methyl-acrylate copolymer (EMA), etc. are mentioned.

[0007] Although a copolymer (FEP) of 6 polytetrafluoroethylene resin (PTFE), 3 fluoride-salt-ized ethylene resin (PCTFE), polyvinylidene fluoride resin (PVDF), ethylene tetrafluoride, and propylene fluoride etc. is mentioned and independent or two sorts or more can be used together and used that what is necessary is just thermoplastics which has carbon-fluorine association in intramolecular as fluorine system resin of fluorine system resin impalpable powder used for this invention, PTFE is desirable especially. Impalpable powder of such fluorine system resin is obtained by processing a radioactive decay etc. for example, to fluorine system resin. Although especially mean particle diameter of fluorine system resin impalpable powder should not be limited, the range of 3-25 micrometers is mentioned preferably. 40-150 weight section combination of the fluorine system resin impalpable powder is carried out per polyethylene system polymer 100 weight section. With [the loadings] the above [under], detachability with enough metals is not acquired, but on the other hand, if the above-mentioned range is crossed, a mechanical property will fall.

[0008] As conductive carbon black used for this invention, acetylene black, furnace black, KETCHIEN black, etc. are mentioned. As described above, 10-100 weight section combination of the conductive carbon black is carried out to the matrix 100 weight section, but if conductivity indispensable as a semi-conducting layer is not acquired under by the above but the loadings cross the above-mentioned range on the other hand, a mechanical property will fall.

[0009] When a half-conductive resin constituent of above-mentioned this invention is used for a semi-conducting layer in contact with a metal shield tape of a high-tension-power cable, lubricity with this electric shielding tape increases mainly according to an operation of fluorine system resin impalpable powder, while especially detachability is improved, with a drum volume or crookedness, a wrinkling arises on a metal shield tape, or there is no possibility of a metal shield tape that failure may arise in an external semi-conducting layer in it. Moreover, in service temperature of the usual high-tension-power cable, since fluorine system resin impalpable powder is a solid-state, bleeding of it is carried out like silicone oil beyond necessity, and it does not have a problem of stickiness arising on a metal shield tape, or soiling on it. Moreover, since the melting point of fluorine system resin impalpable powder is near 320 degree C, it has the advantage that bridge formation processing etc. is processible at a high temperature compared with silicone oil. In addition, in the case of PTFE, it is stable in -200 degrees C - 250 degrees C. Moreover, generally, as compared with other plastics, fluorine system resin is excellent in electrical characteristics while having good thermal resistance, cold resistance, chemical resistance, weatherability, non-absorptivity, and non-adhesiveness. For this reason, also in a half-conductive resin constituent of this invention, such a property can be suitably given alternatively by adjusting loadings of fluorine system resin impalpable powder.

[0010] A half-conductive resin constituent of this invention can contain an additive of arbitration besides the three above-mentioned component, for example, organic peroxide for bridge formation, processing aid, an antioxidant, etc. As organic peroxide for bridge formation, it is dicumyl peroxide, 2, and 5-dimethyl-di-tert-butyl peroxide hexyne, for example. - 3, 1, and 3-screw (t-butyl PAOKI seesaw propyl) benzene etc. is mentioned, and it is preferably used in the range of 0.5 - 5 weight section to the

matrix 100 weight section. As processing aid, stearin acid, zinc stearate, etc. are mentioned and 4,4'-thiobis (6-t-butyl-3-methyl phenol) etc. is mentioned as an anti-oxidant.
[0011] a high-tension-power cable using a half-conductive resin constituent of this invention -- at least -- a conductor -- this -- a thing over which have a semi-conducting layer to each of the inside (namely, between a conductor and insulating materials) of an insulating material which covers a conductor, and this insulating material, and an outside, and one [at least] semi-conducting layer (desirable at least lateral semi-conducting layer) of semi-conducting layers of the inside and an outside made a half-conductive resin constituent of above-mentioned this invention construct a bridge is desirable. In such a high-tension-power cable, as for a semi-conducting layer of this outside, a metal shield tape is wound, and this metal shield tape is usually further covered with insulating materials, such as a sheath.
[0012] Although physical bridge formation of electron beam irradiation etc. is sufficient as bridge formation of a semi-conducting layer, its chemistry bridge formation by organic peroxide for bridge formation included in a half-conductive resin constituent of this invention is desirable, and it is desirable to construct a bridge by 250-300 degrees C and heat-treatment for 1 - 5 minutes at the time of high-tension-power cable formation. A high-tension-power cable can be manufactured by carrying out coincidence extrusion molding of the semi-conducting layers of the inside containing the above-mentioned resin constituent, and an outside.
[0013]
[Example] Hereafter, although the example of this invention is explained, this invention should not be limited to this.
It is a polyethylene system polymer at the ratio (weight section) shown in the table 1 below <an example 1 - 5 and the examples of a comparison 1-4>. As EEA (EVAFLEX-EEA A-709[Mitsui and DEYUPON poly chemical]) and fluorine system resin impalpable powder As PTFE impalpable powder (KTL610: mean particle diameter of 15 micrometers) [Kitamura], and conductive carbon black After kneading with a roll the half-conductive resin constituent which blended furnace black (Balkan Peninsula XC-72 [Cabot]) or KETCHIEN black (KETCHIEN black EC [LION]), and organic peroxide (1, 3-screw (t-butyl PAOKI seesaw propyl) benzene), It pressed in 300 degrees C and 5 minutes with the heat press-forming machine, and the sheet of 1mm thickness was obtained. It evaluated about a mechanical property, detachability, and conductivity using this sheet.
[0014]
[A table 1]

表1

	実施例1	実施例2	実施例3	実施例4	実施例5	比較例1	比較例2	比較例3	比較例4
EEA	50	70	40	50	50	80	30	50	50
PTFE微粉末	50	30	60	50	50	20	70	50	50
ファーネスブラック	50	50	50	70		50	50	110	
ケッチェンブラック					10				5
有機過酸化物	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
機械的特性	○	○	○	○	○	○	×	×	○
剥離性	○	○	○	○	○	×	○	○	○
導電性	○	○	○	○	○	○	○	○	×

[0015] Appraisal-method mechanical property: The **** elongation value (JIS 3 No.) was calculated. O More than :200%, x:less than 200% detachability : the load was hung in piles and the sample and the copper tape were held between days to the 120-degree C thermostat. Then, the friction test was performed.
O :2.0kgf / x:2.0kgf / 1.27cm or more conductivity smaller than 1.27cm : it asked for the volume resistivity (ASTM D991).
O : 105 Below omega-cm and x:105 It is size from omega-cm. [0016] From a table 1, since the half-conductive resin constituent which has the rate of a compounding ratio of this invention was used, examples 1-5 have been satisfied also about a mechanical property, detachability, and which a conductive property. The example 1 of a comparison is what carried out fluorine system resin impalpable powder 20 weight section combination (per [as / Namely, / a matrix] polyethylene system polymer 100 weight section fluorine system resin impalpable powder 25 weight sections combination) to the polyethylene system polymer 80 weight section as a matrix, there is less fluorine system resin impalpable powder than this invention range, and a metal shield tape cannot exfoliate easily. The example 2 of a comparison is what carried out fluorine system resin impalpable powder 70 weight section combination (per [as / Namely, / a matrix] polyethylene system polymer 100 weight section fluorine system resin impalpable powder 233 weight sections combination) to the polyethylene system polymer 30 weight section as a matrix, and there is more fluorine system resin impalpable powder than this invention range, and it does not satisfy a mechanical property. The example 3 of a comparison is what carried out 110 weight sections combination of the conductive carbon black, and the matrix 100 weight section has more conductive carbon black than this invention range, and it is not satisfied with it of a mechanical property. The example 4 of a comparison is what carried out 5 weight sections combination of the conductive carbon black at the matrix 100 weight section, there is less conductive carbon black than this invention range, and conductivity is not satisfied.
[0017]
[Effect of the Invention] The half-conductive resin constituent of this invention can offer a high-tension-power cable with the semi-conducting layer which Siwa was not based on a metal shield tape and was excellent in elongation, detachability, and conductivity, when a high-tension-power cable is crooked,

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MEANS

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機械的特性	○	○	○	○	○	○	×	×	○
剥離性	○	○	○	○	○	×	○	○	○
導電性	○	○	○	○	○	○	○	○	×

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CLAIMS

[Claim(s)]
[Claim 1] A half-conductive resin constituent for high-tension-power cables characterized by including the matrix 100 weight section of combination, and conductive carbon black 10 - the 100 weight sections which consist of the polyethylene system polymer 100 weight section, and fluorine system resin impalpable powder 40 - the 150 weight sections.
[Claim 2] A half-conductive resin constituent for high-tension-power cables according to claim 1 which said polyethylene system polymer is an ethylene ethyl-acrylate copolymer, and fluorine system resin impalpable powder is polytetrafluoroethylene resin impalpable powder, and is characterized by choosing conductive carbon black from acetylene black, furnace black, and KETCHIEN black.
[Claim 3] Furthermore, a half-conductive resin constituent for high-tension-power cables according to claim 1 or 2 characterized by including organic peroxide for bridge formation.

[Translation done.]